

CITY OF NEW LONDON

BEST MANAGEMENT PRACTICE GUIDELINES FOR THE TREATMENT AND CONTROL OF INVASIVE PLANT SPECIES



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The City of New London has joined the Sustainable CT program that seeks to support, sustain and restore species diversity. This includes employing best practice management of invasive plants on municipal properties.

Introduction



The purpose of this document is to provide City staff with background and guidance for the identification and management of the most common and pernicious invasive species occurring in the City of New London. Invasive plants are mostly non-native species which have adaptations that allow them to quickly out-compete natives. They tend to thrive on sites that have been disturbed by clearing, filling, dumping, grading, etc. The City Public Works Department maintains 370 acres including parks, school grounds, City facilities, roadsides and traffic islands.

Impacts of Invasive Plants



Degradation of Natural Areas

Invasives disrupt native ecosystems and wildlife habitat. Species like Knotweed and Phragmites develop dense thickets that crowd out all other species.

Dangers to Human Health and Safety

Certain species like Poison Ivy (a prolific native) can cause a severe allergic reaction; Japanese Barberry provides ideal habit for ticks.



Reduced Visibility

Plants like Knotweed, Bittersweet and Multiflora Rose can obscure trash and hide undesirable human activities. Fast growing plants can obscure sight lines to crosswalks, roadway intersections and driveways.

Fire Hazards

Herbaceous species that die back in winter produce large quantities of flammable material.



Adverse Impacts on Recreation and Aesthetics

Invasive plants can cover trails and other places where people recreate. They can block views of shorelines, fields and meadows, and overwhelm landscaped areas.

Economic Costs

Control methods require manpower and materials that are typically constrained by tight municipal budgets. Preventative actions can reduce future costs of invasive plant controls but require that Public Works and/or Parks Departments program projected expenses into their annual budgets.



Framework For Invasive Species Management

PREVENTION

Begin by identifying locations where invasives are prevalent and record on a city map, or if possible on the City's GIS Database.

Avoid practices that enable their spread. Invasives become easily established when ground has been disturbed and soil left exposed. Always cover soil with thick mulch such as tree trimming chips, turfgrass, or hardy groundcover plants.

Identify high risk areas and ecosystems and actively monitor for appearance of invasive species. Track observations and actions if possible.



DETECTION

Use the Visual Guide sections of this report to identify invasive species. Additional resources are available online from the Connecticut Invasive Plants Working Group. CIPWG holds a biennial symposium in the Fall where attendees learn about current issues and resources.

CONTROL AND MANAGEMENT

Develop a prioritized list of hot spots with severe infestations. Allow for prioritization of newly emergent infestations. Eradication methods are divided into four categories:

1. Mechanical Control

These methods are most effective if repeated throughout the growing season. Frequent interventions exhaust a plant's root reserves and can be amplified if used in combination with other techniques. Mechanical control can be safely implemented by staff and is suitable for volunteer efforts. Methods include:

- Hand pulling
- Weed wrenching
- Cutting (especially vines)
- Mowing
- Digging
- Bush hogging
- Prescribed burning
- Tractor pulling with chain or Brush Brute
- Soil solarization *

* **Soil solarization** involves heating the soil by covering it with a clear plastic tarp for 4-6 weeks during summer when the soil will receive the most direct sunlight. Where applied, the top 6 inches of the soil will heat to as high as 140°F. The plastic covering traps the sun's radiant energy in the soil, and kills a wide range of soil borne pests, such as weeds, weed seeds, pathogens and nematodes. It also accelerates the breakdown of organic material, resulting in the release of soluble nutrients - making them more available to plants.

2. Chemical Control

Exclusive use of herbicides is not recommended. Their sole use is not likely to be an effective long-term solution for controlling invasives. The decision to use chemical controls must be carefully considered. Challenges include controlling only target plants at the correct time during their life cycle and potential health risks to staff and the environment.

Herbicides must only be applied by trained and licensed personnel. In combination with physical methods of reducing the above-ground portion of a plant, herbicides may limit re-sprouting or effectively control plants when used in combination with other techniques. Typically, herbicides are used in small quantities for a stump application after a plant is cut back or are used to control subsequent re-sprouts.

The environmental damage from invasives is considered by some researchers and practitioners to be greater than the risk associated with the limited use of non-persistent herbicides. A current list of herbicides recommended for Connecticut invasive plants can be accessed here:

<https://cipwg.uconn.edu/common-herbicides/>

3. Biological Control

Cutting edge Bio-control involves the introduction of species-specific predators from a plant's native habitat (usually on another continent). The intentional introduction of exotic insects for the control of plant species is one of the few methods proven effective in controlling widespread

invasive plants; however, the potential risks associated with exotic species introductions are high, and only thoroughly researched State DEEP or USDA approved programs can be considered. As time passes, new approaches may be available for common invasives of Connecticut.

A more conventional method is the use of grazing animals, such as goats and pigs. Goats will graze most vegetation in a cordoned area while pigs will root and consume all plants entirely except trees. Treated areas must be re-vegetated immediately following the animal's removal to prevent re-establishment of invasives.

4. Cultural Control

Involves changes to the structure or nutrient availability of a site to create conditions unfavorable to invasive plants. This method can include:

- Minimizing the edge habitats that are prone to invasion (e.g. mowing a perimeter around a sensitive area)
- Amending soil to tie up excess nutrients
- Replanting with a diversity of desirable species that can crowd/shade-out invasive species.

DISPOSAL METHODS

A definitive guideline for disposal was produced by the CT DEEP and UCONN, "Guidelines for Disposal of Terrestrial Invasive Plants, 2014". See Appendix 1 or reference online at:

<https://cipwg.uconn.edu/cipwg-publications/>

RESTORATION AND REHABILITATION

Following initial control, the greatest challenge for the City will be the sustainable establishment and management of sites free of invasive species domination. It is unrealistic to expect municipal landscapes like road right of ways, parks and open space to be completely free of invasive species. Depending on a site's use and visibility, the level of restoration investment and management intensity should be determined.

If periodic mowing is the only realistic management method, a site should be seeded with grasses and/or native mixes that can thrive without inputs of supplemental water, mulch and fertilizer. Native seed mixes for roadsides, fields/meadows, bioswales, etc are available from a variety of regional suppliers. Greatest probability of successful seed establishment occurs when seeding is done in Spring.

Since most invasives are suppressed by dense shade, an alternative strategy for restoration would be planting of native trees such as Maple, Birch, and Oak. Plant surrounding ground with shade tolerant seed mixes of grass and sedge.

High visibility sites such as roadside gateways, park gathering areas, municipal facilities, or municipal property targeted for development may warrant more intensive restoration inputs. These could be designed for maximum aesthetic impact and planted with native shrubs, trees and wildflower/grass mixes.

LABOR CAPACITY AND EQUIPMENT

The Department of Public Works maintains City properties. The Division of Parks & Grounds has primary responsibility for vegetation management, but invasive plants are also encountered by Divisions of Solid Waste and Highway Maintenance.

Community volunteers have assisted the City with park and roadside cleanups including invasives removal in places like Riverside Park, Bates Woods Park, and Ocean Beach. These volunteer activities are typically organized with support from DPW. Only hand tools are permitted when working on City property.

To inquire about volunteer opportunities, contact the Crew Leader of the Division of Parks and Grounds:

860-447-5250



New London's Priority Invasives



TREES

Acer platanoides / Norway Maple

Ailanthus altissima / Tree of Heaven

Paulownia tomentosa / Princess Tree



SHRUBS

Berberis thunbergii / Japanese Barberry

Elaeagnus angustifolia / Russian Olive

Elaeagnus umbellata / Autumn Olive

Euonymus alatus / Burning Bush

Rosa multiflora / Multiflora Rose

Rosa rugosa / Rugosa Rose

Rubus phoenicolasius / Wineberry





HERBACEOUS

Artemisia vulgaris / Mugwort

Polygonum cuspidatum / Japanese Knotweed



VINES

Celastrus orbiculatus / Oriental Bittersweet

Cynanchum orbiculatus / Black Swallow-wort

Lonicera japonica / Japanese Honeysuckle



WETLAND

Lythrum salicaria / Purple Loosestrife

Phragmites australis / Common Reed

NUISANCE SPECIES

Toxicodendron radicans / Poison Ivy



Norway Maple

Acer platanoides

Norway maple is a large tree that spreads by numerous, rapidly germinating seeds, and can dominate forest stands and create dense shade. Prefers full sun and tolerates hot dry conditions and extremes in soil conditions. It is found in forests, forested wetlands, open disturbed areas, roadsides, vacant lots, yards and gardens.

FLOWERS: April to May

FRUITS: Summer

IDENTIFICATION:

- Tree, up to 100' tall
- Opposite, five-lobed, hand-shaped leaves, with long pointed tips
- Regularly grooved bark
- Upright, flat-topped bright yellow-green flower clusters
- Fruits mature into wide-spreading wings that look like helicopter blades
- Foliage turns yellow in fall
- Milky white sap in leaves and stems

MECHANICAL CONTROL:

Pull seedlings when soil is moist. Dig out larger plants with roots. Cut down large trees and grind out stumps or clip off re-growth. Girdle trees in the Spring.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Sugar Maple - *Acer saccharum*
Red Maple - *Acer rubrum*

Oak Species - *Quercus*

Tree of Heaven

Ailanthus altissima

Tree of Heaven is a rapidly growing tree that spreads by wind dispersed seeds and root suckering. Because it tolerates poor soils and pollution it thrives in urban areas.

FLOWERS: June to July

FRUITS: Fall

IDENTIFICATION:

- Tree, up to 80' tall
- Large, alternate compound leaves with pointed leaflets
- Small glands on the underside of leaves
- Smooth stems with pale gray bark
- Large clusters of yellow flowers
- Red-brown seeds with papery wings that are retained through Fall and into Winter
- Unpleasant odor when in flower

MECHANICAL CONTROL:

Hand pull young plants when the soil is wet or cut larger plants repeatedly at ground level to exhaust root reserves. To prevent seed production, cut plants before or while they are in flower.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Eastern Redbud - *Cercis canadensis*
Flowering Dogwood - *Cornus florida*

Shadbush - *Amelanchier canadensis*
Smooth Sumac - *Rhus glabra*

Staghorn Sumac - *Rhus glabra*

Princess Tree

Paulownia tomentosa

Paulownia tomentosa is an aggressive tree that invades disturbed natural areas including forests, roadsides, and stream banks. It also thrives in urban areas. It can reproduce from root sprouts or seeds which can be spread by wind or water.

FLOWERS: April to May

FRUITS: Fall

IDENTIFICATION:

- Tree, 30-60' in height and 24" in diameter
- Trunk has rough, gray-brown bark with interlaced smooth and often shiny areas
- Deciduous leaves are opposite and broadly ovate. Surfaces are pubescent and dull, light-green above, and pale-green and tomentose beneath
- Large , showy , fragrant blossoms are borne in upright clusters 6- 12 inches long
- Brown, woody, beaked, ovoid capsules are 1.5 in long, borne in terminal clusters. The seed pod has four compartments that contain as many as 2,000 tiny winged seeds

MECHANICAL CONTROL:

Cutting: Cut trees at ground level with power or manual saws. Cutting is most effective prior to flowering to prevent seed production.

Hand Pulling: Plants should be pulled as soon as they are large enough to grasp but before they produce seeds. Seedlings are best pulled after a rain when the soil is loose. The entire root must be removed since broken fragments may resprout.



Photos credit: North Carolina State University Plant Extension, <https://plants.ces.ncsu.edu>

NATIVE ALTERNATIVES

Northern Catalpa - *Catalpa speciosa*

Japanese Barberry

Berberis thunbergii

Japanese Barberry is a spiny shrub with a dense twiggy form. It is dispersed to new areas by birds that eat the bright red fruits. It provides optimal habitat for ticks. Tolerant of a broad range of soil moisture and light conditions, it grows in various habitats, from open fields to shaded woodlands to wetlands.

FLOWERS: April to May

FRUITS: Late Summer

IDENTIFICATION:

- Small shrub, 2 to 5 feet tall
- Thin, single thorns on stems
- Alternate, teardrop shaped leaves that develop before trees leaf out
- Pale yellow flowers in clusters on the underside of branches
- Bright red berries that often persist into winter.

MECHANICAL CONTROL:

Hand pull seedlings and dig larger plants. Roots are shallow so infestations are fairly easy to control by physical removal.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Northern Bayberry - *Myrica pensylvanica*
Summersweet Clethra - *Clethra alnifolia*

Winterberry - *Ilex verticillata*
Inkberry - *Ilex glabra*

Sweet Fern - *Comptonia peregrina*

Russian Olive

Elaeagnus angustifolia

Russian Olive is a deep-rooted tree with a medium to rapid growth rate. It can grow up to six feet per year and creates a well developed lateral root system. It can resprout from the root crown and sends up root suckers and tolerates a wide variety of growing conditions.

FLOWERS: May to June

FRUITS: August to October

IDENTIFICATION:

- Large shrub or small tree form, 15-20' tall
- Leaves are alternate, lance-shaped and silver-gray in color
- Dark, smooth bark
- Twigs are very flexible and bear a terminal spine
- Flowers are yellow and aromatic and form is small clusters
- Fruit is dry, olive-like and hard.

MECHANICAL CONTROL:

Russian Olives with small diameters can be removed with a weed wrench when soils are moist. In certain situations larger trees can be removed using a tractor/chain or Root Brute. Any remaining exposed roots should be cut off below ground level and buried.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA. Also [Www.mnstate.wildflowers.com](http://www.mnstate.wildflowers.com)

NATIVE ALTERNATIVES

False Indigo - *Amorpha fruticosa*
Nannyberry - *Viburnum lentago*

Chokecherry - *Prunus virginiana*
Gray Dogwood - *Cornus racemosa*

Pin Cherry - *Prunus pensylvanica*
Pussy Willow - *Antennaria neglecta*

Autumn Olive

Elaeagnus umbellata

Autumn Olive is a fast-growing deciduous shrub or tree. It thrives in disturbed areas, open fields, forest margins, roadsides and clearings. It does not grow well in wet or shady sites and it spreads easily by wildlife dispersal.

FLOWERS: April to May

FRUITS: September to November

IDENTIFICATION:

- Large shrub or small tree form, 15-20' tall
- Leaves are alternate, oval and dark gray-green in color with silvery scales underneath
- Silver-brown stems covered with numerous brown lenticels Light gray bark.
- Flowers are creamy to light yellow in color and fragrant
- Fruit color is brown and then turns to dark red with small silver dots

MECHANICAL CONTROL:

Autumn Olives with small diameters can be removed with a weed wrench when soils are moist. In certain situations larger trees can be removed using a tractor/chain or Root Brute. Any remaining exposed roots should be cut off below ground level and buried.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Bayberry - *Myrica Pensylvanica*
Chokecherry - *Prunus virginiana*

Winterberry - *Ilex verticillata*
Inkberry - *Ilex glabra*

Beach Plum - *Prunus maritima*

Burning Bush

Euonymus alatus

Burning Bush is a deciduous shrub that is common in landscapes and along roadways. It spreads when the fruit is ingested and dispersed by wildlife. It is tolerant of many soil and moisture conditions and will grow in sun or shade.

FLOWERS: May to June

FRUITS: August to January

IDENTIFICATION:

- Large shrub, 5 to 10 feet tall.
- Corky, wing-like ridges on stems
- Opposite, oval to tear-drop shaped finely toothed leaves
- Bright red fall foliage
- Showy red-purple fruits split open to reveal bright red-orange fleshy seeds.

MECHANICAL CONTROL:

Pull or dig young plants, making sure to remove the entire root. Large plants can be cut at ground level but will resprout from the base, so repeated cutting is necessary.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Arrowwood Viburnum - *Viburnum dentatum*
Highbush Blueberry - *Vaccinium corymbosum*

Brilliant Chokeberry - *Aronia arbutifolia 'Brilliantissima'*
Redvein Enkianthus - *Enkianthus campanulatus*

Multiflora Rose

Rosa multiflora

Multiflora rose is a thorny deciduous shrub that can both climb like a vine and form dense thickets. It spreads by root suckering, tip layering and wildlife dispersal. It is often found growing in old fields, along roads, on streambanks and in forest gaps.

FLOWERS: May to June

FRUITS: September to October

IDENTIFICATION:

- Shrub with long, slender arching branches and sharp, curved thorns
- Compound leaves composed of oval to lance-shaped leaflets
- Feathery, deeply fringed stipule at base of each leaf
- Clusters of fragrant white flowers
- Small, smooth, reddish rosehips persist into early winter.

MECHANICAL CONTROL:

Hand pull small plants, or dig and pull large plants removing all of the roots since fragments can resprout. Repeated mowing can also control growth, but will probably not result in eradication.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Winterberry - *Ilex verticillata*

Highbush Blueberry - *Vaccinium corymbosum*

Brilliant Chokeberry - *Aronia arbutifolia 'Brilliantissima'*

Summersweet Clethra - *Clethra alnifolia*

Rugosa Rose

Rosa rugosa

Rosa rugosa is a deciduous shrub. It sends out woody rhizomes which can expand or create infestations. It also spreads by seeds and fruit which can be transported by water, birds or small animals. It thrives on beach dunes and coastal habitats and is tolerant of salt spray and poor soils.

FLOWERS: May to July

FRUITS: Summer

IDENTIFICATION:

- Large shrub, 4 to 7 feet tall.
- Leaves are pinnately compound with 5 to 9 serrated oval leaflets
- Leaves are heavily veined, appearing wrinkled
- Stout green stems covered in thorns
- Showy, dark pink fragrant flowers. Color may occasionally be white or light pink
- Fruit is ~1" round and red in color. Referred to as rose "hips"

MECHANICAL CONTROL:

Small plants and seedlings may be pulled up by the roots when soil is moist; larger plants can be cut, but re-sprouting will occur. Persistent cutting or mowing multiple times during the growing season over several years may kill the plant, but diligence is required. Mowing can prevent seedlings from establishing.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Virginia Rose - *Rosa virginiana*

Wineberry

Rubus phoenicolasius

Wineberry is a deciduous spiny shrub that forms dense thickets. It spreads by seeds eaten by birds and mammals and also spreads vegetatively, when new plants sprout from the tips of canes that touch the ground, and from root buds. It grows along forest, field, stream and wetlands edges and in open woods, preferring moist habitats and sunlight.

FLOWERS: Mid-Summer

FRUITS: June to July

IDENTIFICATION:

- Multi-stemmed shrub with upright, arching stems up to 9 feet, spiny and covered with distinctive reddish hairs
- Leaves consist of three heart-shaped, serrated leaflets with purplish veins and white undersides
- Small greenish flowers have white petals and reddish hairs
- Bright red berries

MECHANICAL CONTROL:

Hand pull plants or use a spading fork, most effective when the soil is moist and the roots and any cane fragments are removed. Cutting canes to the ground repeatedly can also be effective. Branches with berries should be bagged.



Photos credit: University of Massachusetts Amherst Extension Landscape, Nursery & Urban Forestry Program,
<https://extension.umass.edu/landscape/weeds>

NATIVE ALTERNATIVES

Common Blackberry - *Rubus allegheniensis*
Highbush Blueberry - *Vaccinium corymbosum*

Black Raspberry - *Rubus occidentalis*
Red Raspberry - *Rubus idaeus*

Mugwort

Artemisia vulgaris

Mugwort is a perennial weed that spreads aggressively through extensive rhizomes and readily forms large, mono-specific stands. It can be found along sidewalks, backyards, parking lots, forest edges and roadways where the earth is disturbed. It thrives in sunny, well-drained soil, but also tolerates part shade.

FLOWERS: July to late September

FRUITS: August to October

IDENTIFICATION:

- 2 to 5 feet tall.
- Aromatic leaves are deeply lobed with pointed ends, and undersides are light grey-green with silvery hairs
- Spike-like clusters of small, greenish-yellow flowers form at stem terminal
- Stems are vertically grooved, round or square, and branched and become reddish and woody with maturity
- Fruits are dry and one-seeded

MECHANICAL CONTROL:

Mow or cut to ground every 2-3 weeks for at least 2 years. Full shade inhibits regeneration, so hand cut small colonies to not disturb nearby vegetation. Pulling can be effective in combination with other methods. Cut to prevent seedheads, as it can also spread by seed.

Prevent viable seed production by cutting/mowing by mid September.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Beebalm - *Monarda*
Purple Coneflower - *Echinacea*

Joe-pye Weed - *Eutrochium purpureum*
Swamp Milkweed - *Asclepias incarnata*

Japanese Knotweed

Polygonum cuspidatum

Japanese Knotweed is a perennial, herbaceous shrub that grows very aggressively in disturbed areas. It can be found in large, dense thickets along roadsides, wetlands, woodland edges and river banks. It can suppress the growth of native vegetation by limiting light and nutrients from reaching the plants.

They reproduce vegetatively via extensive root and stem fragments.

FLOWERS: Late Summer

MECHANICAL CONTROL:

Cutting or mowing followed by soil solarization.
Mow or cut to ground every 2-3 weeks for at least 2 years during the growing season.

IDENTIFICATION:

- Grows up to 10 feet tall
- Hollow, bamboo-like stems
- Alternate, large, oval leave with square bases and pointed tips
- Small green-white flower clusters
- Plants turn brown and die back with the onset of frost

Prevent viable seed production by cutting/mowing by mid August.



Photos credit: North Carolina State University Plant Extension, <https://plants.ces.ncsu.edu>

NATIVE ALTERNATIVES

Spicebush - *Lindera benzoin*

Buttonbush - *Cephalanthus occidentalis*

Oriental Bittersweet

Celastrus orbiculatus

Oriental Bittersweet is an aggressive vine that can quickly smother other vegetation. It has twining stems that strangle shrub and tree limbs. Spreading occurs by root suckering, and when birds eat the fruit. It's shade tolerant, can grow in a variety of habitats and is quick to invade any newly disturbed area.

FLOWERS: May to June

FRUITS: Late Summer to early Fall

IDENTIFICATION:

- Woody twining vine
- Alternate, nearly round, finely toothed glossy leaves that spiral evenly around the stem
- Fruits have a conspicuous yellow casing that opens to reveal a bright red fleshy interior
- Roots are orange colored

MECHANICAL CONTROL:

Pull small plants including the entire root system. Cut larger vines close to the ground every couple of weeks to prevent resprouting and to deplete the root system.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Trumpet Honeysuckle - *Lonicera sempervirens*
Virginia Creeper - *Parthenocissus quinquefolia*

Fox Grape - *Vitis labrusca*

Black Swallow-wort

Cynanchum louiseae

Black Swallow-wort is a perennial twining vine that can form extensive patches. It spreads through rhizomes and dispersal of seeds by wind. It's found in upland areas and is tolerant of a wide range of light and moisture. It's a threat to monarch butterflies, which lay eggs on swallow-wort, but larvae do not survive. Pale swallow-wort, distinguished by creamy pink to reddish brown flowers, is also a concern.

FLOWERS: June to July

FRUITS: July to September

IDENTIFICATION:

- Herbaceous, twining, unbranched vine up to 6 ½ feet in length
- Oval shaped leaves with pointed tips occur in pairs along the stem
- Clusters of small five-petaled star-like flowers, dark purple with white hairs
- Fruits are slender tapered green pods that turn light brown as they mature

MECHANICAL CONTROL:

Clip or intensively mow. Mowing must be frequent to be effective, and plants should be cut low and any pieces with pods bagged and disposed of. For small populations, dig up the large root masses, and bag and dispose of roots along with any pod-bearing plants.



Photos credit: Minnesota Department of Agriculture,
<http://www.mda.state.mn.us/plants/pestmanagement/weedcontrol/noxiouslist/swallowwort.aspx>

NATIVE ALTERNATIVES

Trumpet Honeysuckle - *Lonicera sempervirens*

Virginia Creeper - *Parthenocissus quinquefolia*

Japanese Honeysuckle

Lonicera japonica

Japanese Honeysuckle is a trailing woody vine commonly found along roadsides, forest edges and disturbed natural areas. It can spread by seeds, rhizomes and runners. It is capable of smothering small trees. It can reduce available light to other species and deplete soil moisture.

FLOWERS: April to July

FRUITS: Fall

IDENTIFICATION:

- Can climb to over 80 ft in length
- Young stems may be pubescent while older stems are glabrous.
- Leaves are opposite, pubescent, oval and 1 - 2.5 in. long
- Small shiny globular fruits turn from green to black as they ripen
- Showy, fragrant, tubular, whitish-pink flowers develop in the axils of the leaves. The flowers turn cream-yellow as they age

MECHANICAL CONTROL:

Small patches of Japanese honeysuckle can be eliminated by hand pulling and removal of trailing vines. This is most effective when the soil is moist. All roots and shoots need to be removed from the site and disposed of properly. Mowing is NOT recommended, as it stimulates growth and leads to denser mats of vegetation.



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Trumpet Honeysuckle - *Lonicera sempervirens*
Virginia Creeper - *Parthenocissus quinquefolia*

Purple Loosestrife

Lythrum salicaria

Purple Loosestrife is a perennial found in wet soil habitats. It is commonly found in roadside ditches. It can be aggressive in wetlands, eliminating native plants like cattails, sedges, bulrush and ferns. It spreads primarily by seeds with the help of wind, water, wildlife and humans.

FLOWERS: July to October

FRUITS: Highly prolific seed production

IDENTIFICATION:

- Grows up to 5 feet in height
- The opposite or whorled leaves are dark-green, lance-shaped, sessile, 1.5 - 4 in. long and round or heart-shaped at the base
- Square-shaped stem, generally 4 to 6-sided
- Purplish flowers, surrounding small yellow centers, develop in 4-16 in. long spikes at the tops of the stems
- Purple loosestrife produces thick, woody roots. On mature plants, roots are extensive and can send out 30 to 50 shoots, creating a dense web

MECHANICAL CONTROL:

The best time to control purple loosestrife is in late June, July and early August, when it is in flower. Hand-pulling for small populations (less than 1/4 acre). This is easiest if done when plants are young (up to two years). Cutting and removing flower spikes will prevent seeds from producing more plants. Cut the stems at the ground to inhibit growth.

BIOLOGICAL CONTROL:

A research project at UConn has identified the Galerucella leaf-feeding beetle that is benign to the native ecosystem.

Reference to Connecticut's Purple Loosestrife Program:

<http://www.purpleloosestrife.uconn.edu>



Photos credit: University of Connecticut Plant Database, <http://hort.uconn.edu/plants>, Mark H. Brand, Department of Plant Science and Landscape Architecture, Storrs, CT 06269-4067 USA.

NATIVE ALTERNATIVES

Blue Flag Iris - *Iris versicolor*
Cardinal Flower - *Lobelia cardinalis*

Speedwell - *Veronica spicata*
Spiked Gayfeather - *Liatris spp.*

Swamp Milkweed - *Asclepias incarnata*
Lupine - *Lupinus spp.*

Common Reed

Phragmites australis

Phragmites is a stout perennial grass. It's usually found in dense thickets growing in or near shallow water. These thickets displace native wetlands plants, alter hydrology and block sunlight to the aquatic community.

FLOWERS: July to September

FRUITS: July to November

IDENTIFICATION:

- Grows up to 12 feet in height
- Long, lance-shaped, gray-green leaves
- Purple-brown plume-like flowers
- The seeds are brown, light weight, and about 0.3 in. long
- Stalks and plumes turn tan in the fall and remain throughout the winter

MECHANICAL CONTROL:

Hand pulling or digging may be effective on small (less than 18 inches) or very young plants. Mowing is appropriate for small, isolated, low density stands. This should be done from late Summer into the fall

Cutting or mowing followed by soil solarization. Implementation of this method involves first cutting the stand to a height of less than four inches prior to treatment.



Photos credit: USDA PLANTS Database, USDA NRCS PLANTS Database, Bugwood.org; Jil Swearingen, USDI National Park Service, Bugwood.org; Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

NATIVE ALTERNATIVES

Big Bluestem - *Andropogon gerardii*
Broom Sedge - *Andropogon virginicus*

Switchgrass - *Panicum virgatum*
Smooth Cordgrass - *Spartina alterniflora*

Poison Ivy

Toxicodendron radicans

Poison Ivy is a low sprawling shrub or climbing vine. Despite the fact that it is native, Poison Ivy can become rampant and create a public health hazard. It can be found in a large variety of locations including dry or wet woodlands, thickets, roadsides and clearings. Will grow in sun or shade. All parts of the plant contain a toxic plant oil called urushiol which can cause skin irritations when coming into direct contact.

FLOWERS: May to July

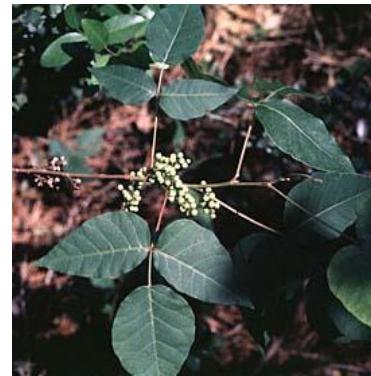
FRUITS: Late Summer

IDENTIFICATION:

- Height incredibly varied: low carpet or climbing vine
- Each leaf has a stem with three leaflets that are smooth or toothed, rounded or pointed and glossy or dull
- Leaflets are glabrous to hairy beneath and turn red-yellow in the fall
- Hard white drupe fruits in clusters
- Small greenish-white flowers in axillary clusters
- Vine covered in aerial roots

MECHANICAL CONTROL:

Remove and destroy plants and root systems by carefully digging them up using rubber gloves and clothing protection for other parts of the body.



Photos credit: North Carolina State University Plant Extension, <https://plants.ces.ncsu.edu>

NATIVE ALTERNATIVES

White Snakeroot - *Ageratina altissima*
Virginia Creeper - *Parthenocissus quinquefolia*

Appendix A

Guidelines for Disposal of Terrestrial Invasive Plants



Guidelines for **Disposal of Terrestrial Invasive Plants**

Produced by:

The Connecticut Department of Energy and Environmental Protection and the University of Connecticut, 2014

INTRODUCTION:

Efforts to control invasive plants may generate large amounts of plant material and soil or sediment containing viable parts. This material must be appropriately managed or it could contribute to the reestablishment and spread of the species at the controlled site, the disposal site or landfill, or elsewhere. In many cases, plants may regrow in future years. It is very important to monitor sites after control efforts to prevent invasive plants from reestablishing and re-invading the area. In general, it is best to control plants early in the season, before they begin to flower. In some cases, fruits and seeds can continue to mature even on plants that have been uprooted, so it is important to check plants for flowers before deciding on a disposal option. It is advisable to leave plants controlled by herbicides in place instead of removing them.

This document focuses on the disposal of invasive plant material after control work takes place and does not include information about invasive plant control. Once control activities dispose of invasive plant materials as safely and effectively as possible, contact your local Cooperative Invasive Plant Working Group (www.cipwg.uconn.edu), use other resources and information on controlling invasive plants on your property, or seek professional advice. This document is intended only as a basic guide.



A purple loosestrife invasion in Wethersfield, CT. Photo by Donna Ellis.

s have concluded, please use these general guidelines to possible. Visit the website of the Connecticut Invasive Plant or ask a gardening or landscape professional for advice . Additionally, remember that each situation is unique and

LEGAL NOTES:

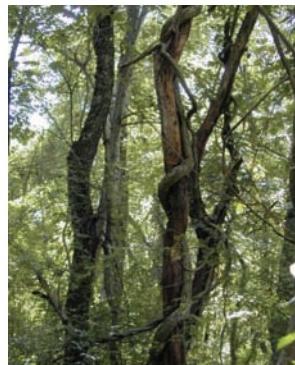
While it is illegal to transport material of any species listed under Connecticut General Statute Sec. 22a-381d as an invasive plant, the statute includes an exception for the moving of plant material for the purpose of eradication. Applications of herbicides in aquatic environments require a permit from the Connecticut Department of Energy and Environmental Protection (CT Gen. Stat. Sec. 22a-66z). Applications of herbicides on a property that is not owned by you require a valid pesticide applicator's license (CGS Sec. 22a-47).

Also, please be aware that it is illegal to transport plant material of any kind (invasive or otherwise) on boats or boat trailers and that boats and boat trailers must be inspected for aquatic plants before being transported (CGS Sec. 15-180). Burning may be conducted through the local Open Burning Official as required by CGS Sec. 22a-174(f), if the town has

an open burning program and the local Open Burning Office approves of the proposed burn. Always check the local fire danger and the Air Quality Index before you burn and follow all federal, state, and local laws and ordinances when conducting invasive plant removal or disposal. Special reporting and disposal instructions exist for giant hogweed (*Heracleum mantegazzianum*) and mile-a-minute vine (*Persicaria perfoliata*). To report giant hogweed, contact Donna Ellis at UConn (860-486-6448; donna.ellis@uconn.edu). To report mile-a-minute vine, send an email to mileaminute@uconn.edu or call Donna Ellis at the number above. For information about the appropriate disposal of aquatic invasive plants, please refer to the DEEP guide on aquatic invasive plant disposal available at www.cipwg.uconn.edu or contact DEEP at 860-424-3589.

TREES, SHRUBS, AND WOODY VINES

The best time to dispose of invasive plants is before plants flower and produce seed. After flowers, fruits, or seeds develop, minimize movement of the plants to prevent unnecessary dispersal. Leave plants on site if possible. Do not compost plants that are actively flowering or fruiting and do not bring to a transfer station, compost site, or brush processing site that may compost or mulch the material.



Asiatic bittersweet, a woody vine, can damage trees as it grows.
Photos by Donna Ellis (left) and Les Mehrhoff, IPANE (right).

Method	Description
Air dry	<p>Plant development stage: Prior to flowering.</p> <p>Small seedlings can be pulled and left with roots exposed to dry out. This material can be left on site or can be composted once it is fully dead and dried.</p>
Chip and compost	<p>Plant development stage: Prior to flowering.</p> <p>Chip and use as mulch on site, or add to compost once fully dead and dried.</p> <p>If during or after flowering, chip but do not compost. Leave on site and monitor. Do not send to a commercial or municipal compost site.</p>
Construct brush piles	<p>Plant development stage: Prior to flowering.</p> <p>Consider using larger woody plants to construct brush piles for wildlife habitat. Pile all material into a single location. Visit www.ct.gov/dep (search "Brush Piles") for information about building brush piles from the Connecticut Department of Energy and Environmental Protection. Make sure all material is fully dead and dried before use. Note: brush piles may create ideal habitat for mice and ticks. Do not construct brush piles near areas of human habitation.</p> <p>If during or after flowering, cover brush pile to prevent spread by birds, etc.</p>
Incinerate	<p>Plant development stage: During or after flowering.</p> <p>Incineration of material may be a viable option if it can be bagged and transported securely to an incinerator. Contact your town to determine if your regular solid waste/trash is incinerated.</p>
Gather material and burn	<p>Plant development stage: During or after flowering.</p> <p>Burn only in accordance with all federal, state, and local laws and ordinances and permits. Monitor weather conditions prior to ignition to avoid hazardous fires. See "Legal Notes" section, above, for more information.</p>
Use as firewood	<p>Plant development stage: During or after flowering.</p> <p>Use as firewood locally. Moving firewood large distances may spread invasive insects. Visit www.dontmovefirewood.org for more information.</p>
Note on vines	<p>It is generally not necessary and sometimes not possible to dispose of vines that may be caught high in trees or wrapped tightly around tree trunks. If the vine is cut at the base and dies, the plant will gradually break apart and fall out of the tree. Dead and dried fallen fragments may be disposed of as described above.</p>
Additional notes	<p>Plant development stage: Prior to flowering or during or after flowering.</p> <p>Large stumps and branches may require special disposal. Contact your town for more information about appropriate disposal options.</p>



HERBACEOUS (NON-WOODY) PLANTS

See next page for information about the disposal of invasive grasses.

Method	Description
Air dry	<p>Plant development stage: Prior to flowering.</p> <p>Pull and leave with roots exposed to dry out. This material can be left on site or can be composted once it is fully dead and dried.</p>
Construct brush piles	<p>Plant development stage: Prior to flowering or during and after flowering.</p> <p>Pile all material into a single location. Visit www.ct.gov/deep (search "Brush Piles") for information about building brush piles from the Connecticut Department of Energy and Environmental Protection. Make sure all material is fully dead and dried before use. Note: brush piles may create ideal habitat for mice and ticks. Do not construct brush piles near areas of human habitation.</p> <p>If during or after flowering, cover brush pile to prevent spread by birds, etc. Placing plastic under the pile may help prevent re-sprouting and covering with plastic may reduce dispersal.</p>
Incinerate	<p>Plant development stage: During or after flowering.</p> <p>After fruits develop, minimize movement of the plants to prevent the unnecessary dispersal of seeds. Leave plants on site if possible. Do not compost on site and do not bring to a transfer station, compost site, or brush processing site that may compost or mulch the material. Incineration of material may be a viable option if it can be transported securely to an incinerator. Contact your town to find out if your regular solid waste/trash is incinerated.</p>
Bag and dispose	<p>Plant development stage: During or after flowering.</p> <p>Do not compost. Bag all material and allow to rot in sunny location for several weeks, then dispose of in trash.</p> <p><i>If volume of material is too large to bag:</i> Remove all flowering heads, secure flowering heads in plastic bag and allow to rot, then dispose of in trash. Wait until following year to attempt control and disposal before flowering.</p>

Composting Exceptions:

Although most invasive plants can be composted once fully dead and dried as noted above, some species should not be composted at all because they have rhizomes or other parts that may survive in compost and spread to new locations when the compost is distributed. Use of these plants in brush piles is also not advisable unless a plastic or other barrier is added to prevent the plants from contacting the ground and re-rooting. Use an alternate method to dispose of these plants.

Scientific Name	Common Name	Reproductive method
<i>Aegopodium podagraria</i>	Goutweed	stolons
<i>Centaurea biebersteinii</i>	Spotted knapweed	shoots
<i>Cirsium arvense</i>	Canada thistle	rhizomes*/creeping stems
<i>Euphorbia cyparissias</i>	Cypress spurge	lateral root buds
<i>Euphorbia esula</i>	Leafy spurge	root fragments
<i>Lepidium latifolium</i>	Perennial pepperweed	rhizomes*/creeping stems
<i>Lysimachia vulgaris</i>	Garden loosestrife	rhizomes*
<i>Ornithogalum umbellatum</i>	Star-of-Bethlehem	bulbs
<i>Polygonum cuspidatum</i>	Japanese knotweed	rhizomes*
<i>Polygonum sachalinense</i>	Giant knotweed	rhizomes*
<i>Ranunculus ficaria</i>	Fig buttercup	vegetative tubers
<i>Rumex acetosella</i>	Sheep sorrel	rhizomes*
<i>Valeriana officinalis</i>	Garden heliotrope	rhizomes*

*rhizome=underground creeping stem



GRASSES AND SEDGES

It may be difficult to tell if a grass is flowering or is already producing fruits. Treat all flowering grasses as if they have already begun to produce viable seeds. Minimize movement of any flowering plants and do not compost. Thoroughly check grasses for flowering prior to control or disposal efforts.



A Japanese stiltgrass invasion in a woodland setting. Photo by Les Mehrhoff (IPANE).

Method	Description
Air dry	Plant development stage: Prior to flowering Pull plants and leave with roots exposed to dry out. Leave on site. Check site in future years for re-sprouting plants.
Bag and dispose	Plant development stage: During or after flowering. Do not compost. Bag all material and allow to rot in sunny location for several weeks, then dispose of in regular trash to be landfilled or incinerated. Note: This is not an appropriate method to dispose of grass clippings created from mowing regular lawns. Grass clippings may not be disposed of in solid waste streams to go to landfills, as this would be a violation of CGS Sec. 22a-208v. This method should only be used to dispose of invasive grasses listed on the Connecticut Invasive Plant List if off site disposal is needed after the plants have been pulled or removed from an area.

Notes:

Special care should be taken when disposing of rhizomatous species such as those listed to the right. Plants that spread readily from root fragments or other plant parts should be disposed of in a way that will not allow the material to continue to grow and spread.

Scientific Name	Common Name	Reproductive method
<i>Butomus umbellatus</i>	Flowering Rush	rhizomes*
<i>Carex kobomugi</i>	Japanese sedge	rhizomes*
<i>Glyceria maxima</i>	Reed managrass	rhizomes*
<i>Iris pseudacorus</i>	Yellow flag iris	rhizomes*
<i>Miscanthus sinensis</i>	Eulalia	rhizomes*
<i>Phragmites australis</i>	Phragmites/Common reed	rhizomes*
<i>Poa compressa</i>	Canada bluegrass	rhizomes*

*rhizome=underground creeping stem

ACKNOWLEDGEMENTS:

This document is based on several previously existing works, particularly a non-native plant disposal document from the University of New Hampshire Cooperative Extension (January 2010), a NH DOT Best Management Practices document (2008), and an aquatic plant disposal document from the Invasive Plant Atlas of New England

(2002). Special thanks to Les Mehrhoff (IPANE), Donna Ellis (UConn), K.C. Alexander, Chuck Lee, Tim Marsh, Nancy Murray and Brad Robinson (DEEP), Logan Senack, and the CT Invasive Plants Council for providing feedback and information for this document.

For more information about invasive plants, visit www.cipwg.uconn.edu or www.ct.gov/deep (search "invasive species").

Photos courtesy of IPANE, Donna Ellis, Stacey Leicht, and Les Mehrhoff.



Appendix B

Guidelines for Chemical Control of Invasive Plants

Guidelines for Chemical Control of Invasive Plants

INTRODUCTION

Exclusive use of herbicides is not recommended. Their sole use is not likely to be an effective long-term solution for controlling invasives. The decision to use chemical controls must be carefully considered. Challenges include controlling only target plants at the correct time during their life cycle and potential health risks to staff and the environment.

Herbicides must only be applied by trained and licensed personnel. In combination with physical methods of reducing the above-ground portion of a plant, herbicides may limit re-sprouting or effectively control plants when used in combination with other techniques. Typically, herbicides are used in small quantities for a stump application after a plant is cut back or are used to control subsequent re-sprouts.

The environmental damage from invasives is considered by some researchers and practitioners to be greater than the risk associated with the limited use of non-persistent herbicides. A current list of herbicides recommended for Connecticut invasive plants can be accessed here:

<https://cipwg.uconn.edu/common-herbicides/>

GENERAL GUIDELINES FOR APPLICATION

TECHNIQUE #1 - Cut-Stump Method

Cut-Stump involves herbicide concentrates or herbicide-water mixtures applied to the outer circumference of freshly cut stumps or the entire top surface of cut stems, applied with a backpack sprayer, spray bottle, wick, or paint brush. Freshly cut stems and stumps of woody stems can be treated with herbicide mixtures to prevent resprouting and to kill roots.

Immediately following cutting of the trees and shrubs at ground-level, glyphosate (25% solution) or triclopyr (50% solution) should be directly applied to the stump. The cut-stump method can be used at all times of the year, as long as the ground is not frozen.

These guidelines can be applied to:

1. *Acer platanoides* - Norway Maple
2. *Ailanthus altissima* - Tree of Heaven
3. *Paulownia tomentosa* - Princess Tree
4. *Elaeagnus angustifolia* - Russian Olive
5. *Elaeagnus umbellata* - Autumn Olive
6. *Rosa multiflora* - Multiflora Rose
8. *Celastrus orbiculatus* - Oriental Bittersweet
9. *Lonicera japonica* - Japanese Honeysuckle
10. *Polygonum cuspidatum* - Japanese Knotweed *Cutting or mowing in early Summer with foliar glyphosate application in late Summer/early Fall.

TECHNIQUE #2 - Foliar Spray Method

Directed foliar sprays are herbicide-water sprays aimed at target plant foliage to cover all leaves to the point of run off, usually applied with a backpack sprayer. With this method, herbicides are thoroughly mixed in water, often with a non-ionic surfactant (such as Alkest TW 80), and applied to the foliage and growing tips of woody plants or to completely cover herbaceous plants. Foliar sprays are usually most effective when applied from midsummer to late fall, although spring and winter applications have use on specific plants and situations. Selective treatment is possible because the applicator directs the spray towards target plants and away from desirable plants. Do not use foliar sprays in windy conditions.

Only use herbicides if mechanical removal is not possible. Application should be made after full leaf expansion and when the plant is actively growing. In early Spring spray foliage with triclopyr, or from mid-summer to fall use either triclopyr or glyphosate.

For larger plants apply glyphosate or triclopyr to freshly cut stumps.

These guidelines can be applied to:

1. *Berberis thunbergii* - Japanese Barberry
2. *Toxicodendron radicans* - Poison Ivy
3. *Euonymus alatus* - Burning Bush
4. *Rosa rugosa* - Rugosa Rose
5. *Rubus phoenicolasius* - Wineberry *Herbicide is not recommended for mature plants.
6. *Celastrus orbiculatus* - Oriental Bittersweet
7. *Cynanchum orbiculatus* - Black Swallow-wort
8. *Lonicera japonica* - Japanese Honeysuckle

TECHNIQUE #3 - Wetland Plants

Herbicide control can be done by hand using glyphosate herbicides if infestation is on a dry, upland area. An aquatic herbicide formulation is required if treatment is to be conducted on or near water.

It is important that herbicide use is as effective as possible, reducing the volume of herbicide used and the number of applications required. The following principles are designed to reduce the risks of herbicide use through minimizing the amount applied, maximizing the death of weed populations, and careful timing of herbicide application.

- Apply herbicide according to the recommended rate.
- If possible, try to spray when surface water levels are low, generally in early winter after germination has occurred, but stream levels have not risen appreciably.
- Ensure that weeds are sprayed at the correct time, usually when they are growing strongly, and before seed set.
- Minimize damage to frogs by determining the species present, and ensuring that as far as possible herbicide is not applied during egg laying, tadpole development or at the point where the juvenile frogs emerge from the water.

- Mix in a colored dye so that you can accurately see which areas have been sprayed, and whether areas have been missed.
- Ensure adequate follow-up of weed treatment, so that repeat treatment is minimized.
- Where possible, wipe or inject weeds with herbicide instead of spraying, to avoid spray drift.
- Do not spray if plants are under stress, such as on very hot days or in very dry or dusty conditions, as uptake of herbicide through leaves will be minimal.
- Do not spray on windy days, or if it is likely to rain soon after application; before the herbicide has been adequately absorbed through the leaf surface.
- Avoid using surfactants, as many of these are more toxic to wetland fauna than the actual herbicide.

These guidelines can be applied to:

1. *Lythrum salicaria* - Purple Loosestrife

2. *Phragmites australis* - Common Reed

